National Radio Astronomy Observatory
Green Bank, West Virginia

November 13, 1963

Memorandum

To: DSHeeschen, WWPieasants, JPCrews, PGMezger, HHvatum, FJCallender, ERFaelten

From: JWFindlay

This is my first draft of the 300-foot design specification. Please suggest modifications if needed. Will WWP and JPC, if needed, discuss with ERF.

JWF/j

Attachment

First Draft (JWF)

Nov. 12, 1963

DESIGN SPECIFICATION FOR A 300-FOOT TRANSIT TELESCOPE

1. General

The design of a 300-foot transit telescope is required. The first phase of this design should be completed by February 15, 1964. This phase should establish the structural and mechanical plan of the telescope in sufficient detail for reliable estimates of performance and cost to be made.

The general principles accepted in the design of the existing 300-foot should be followed, with modifications necessary to ensure satisfactory operation at 3000 Mc/s (10 cm) and with the increased sky cover required. The design should not call for specific fabrication methods which might unnecessarily limit the bidders for the final fabrication and erection contract.

In what follows, the design parameters of the instrument are set out. These should be regarded by the designer as his general guide lines. The Observatory and the designer will work together during the design to make any of the following parameters clearer in definition, or to agree to small changes in them if this be necessary.

2. Design parameters

(a) Service conditions

Location -- Green Bank, West Virginia.

38° 26' N 79° 50' W, Elevation 2700 feet

✓ Ambient temperature -- Operate 0°F - 105°F

✓ Withstand - 20°F - +120°F

✓ Wind loads. Operate in winds 0 - 25 MPH, with no snow or ice loading.

✓ Be capable of moving from any position back to the stow position with a 50 MPH wind from any direction, but with no snow or ice load.

✓ Withstand ~~100~~ 72 MPH wind from any direction, ~~when carrying no snow or ice load, when telescope is stowed.~~ - ANY POSITION

Withstand a coating of 1/2" of ice and a simultaneous 50 MPH wind from any direction when stowed. 10#/SQ. FT. 10#/SQ FT.

Withstand a ~~15~~ 20 lbs/sq foot snow load uniformly over surface when in the stow position with no wind.

(b) Sky coverage

A transit telescope with its elevation axis on an E-W line. The telescope should move 52° from the zenith towards the North, and 72° from the zenith towards the South. The design should not require excavation of the ground to achieve this southerly cover. - 7' UNDER GROUND -

(c) Reflector and feed support

The present choice for reflector material is 5/8" x .091 aluminum squarex or equivalent.

The reflector should have an f/D ratio very close to 3/7. Thus a focal length of 128.5 feet would be reasonable.

The instrument is intended to work at 10 cm. From experience in designing the 300-foot, this criterion should be met if the following conditions are satisfied by the reflector surface and its support structure.

(i) Dish at zenith. The reflector surface should not have an RMS deviation from a best fit parabolic surface of focal length F_o of more than 0.5 cm (.197 inches). The value of F_o shall be 128.5 feet $\pm$ 1 inch.

(ii) Dish at any other elevation angle. The reflector surface should still have an RMS deviation from a best fit paraboloid of not more than 0.5 cm. The best fit paraboloid should have a focal length equal to $F_o \pm 1$ inch.

{Note: The 0.5 cm RMS gives A_{eff} = 44% at 3000 Mc/s if max A_{eff} = 65%. The change in F_o as the dish tilts gives about 5% change in gain.}

(iii) The feed support. The feed support should carry an observing platform or enclosure about 12 feet square, with its floor about 2 feet above the focal point. Details of this will be worked out with NRAO staff.

The feed support should be capable of carrying 1500 lbs of added weight over and above the platform or enclosure weight. With this total load the focal point should not move more than 2 inches in a direction perpendicular to the dish axis, nor more than 1 inch parallel to this axis, as the telescope moves from the zenith to 72° south.

(d) Drive system

The drive should provide a variable rate from 20°/minute to 1°/minute. The drive system chosen should permit of a servo control of the drive rate, although this servo system need not be designed in Phase I.

(e) Position indicators

The telescope position will be indicated by digital encoder disks mounted at the elevation bearing, reading to 10" of arc digit interval. The Observatory will provide drawings of such encoders and couplings. The design should show how they will be mounted.

Although the structure will deflect, and careful calibration of the position of the radio beam in the sky will be necessary, it is desirable that such calibrations will be repeatable (in no wind, ice or snow, and with the focal point load the same) to 20" of arc.

3. Limits of the design

The scope of design work should end at approximately the following points:

(a) Structure and foundation

Carry the design to the BOTTOM of the foundation work needed. Give

loads, moments, etc., required of foundation. Do not design foundation.

(b) Drive

Carry the elevation drive through to the drive package and brake system. Do not design limit switches, control wiring, control console, nor servo drive system.

(c) Indicator system

Do not design system. Show only how indicators could be mounted.

(d) Access ladders, walkways, hoists, etc.

Design ladders and walkways to give access to focal point, center of dish and main bearings. Include a hoist to carry 1000 lbs of equipment from the ground to the focal platform. Make a 5 foot diameter hole where needed to allow this equipment to pass through dish.

(e) Buildings, site preparation, cable ducts, troughs, etc.

No design required.

JWF